Pacific Whiting MSE DRAFT Work Plan
September, 2017 - December, 2019
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Purpose: The purpose of this document is to establish a plan of work and timeline for the development of this iteration of the Pacific Whiting Management Strategy Evaluation. This document, when finalized, bounds the scope of this iteration of the MSE, and serves as an agreement between the JMC, stakeholders, and the MSE project team for what the MSE exercise and simulation tool will accomplish.

Introduction:
Management Strategy Evaluation (MSE) is a flexible approach that supports decision-making and has a wide range of potential applications. Management strategy evaluation may be used to explore the performance of management procedures (the things we can control, like how biomass is translated to allowable catch or how intensely the population is monitored) in light of different kinds of uncertainty. Uncertainty is what we cannot control and may include aspects like variable ocean conditions and the inability to know parameter values with precision.

Management Strategy Evaluation is not a product or a single model, rather it is an iterative process. This iteration of the MSE is intended to last two years, and that is the period of time that this work plan covers. Within that time, multiple phases of simulation results will be presented and discussed with the JMC, SRG and MSE working group.

Background and previous Hake MSE work:
MSE-style simulations were last presented to the JMC in Spring 2015.
Goals of previous iterations of the MSE were (summarized in Hicks et al. 2014):

- Defining objectives of the fishery and performance metrics,
- Developing understanding of short-term and long-term implications of harvest control rules for Pacific hake (MSC certification motivation- conservation performance of the harvest strategy).
- Explore importance of sampling and shifts in sampling (age 1 index of abundance)
- Explore how a shift in age structure toward younger fish limits biomass of older hake in Canada

Features of previous iterations:

- the operating model used to generate hake population dynamics was the same as the assessment model
- simulations focused on testing control rules and time-varying selectivity

Feedback on previous iterations from the SRG:

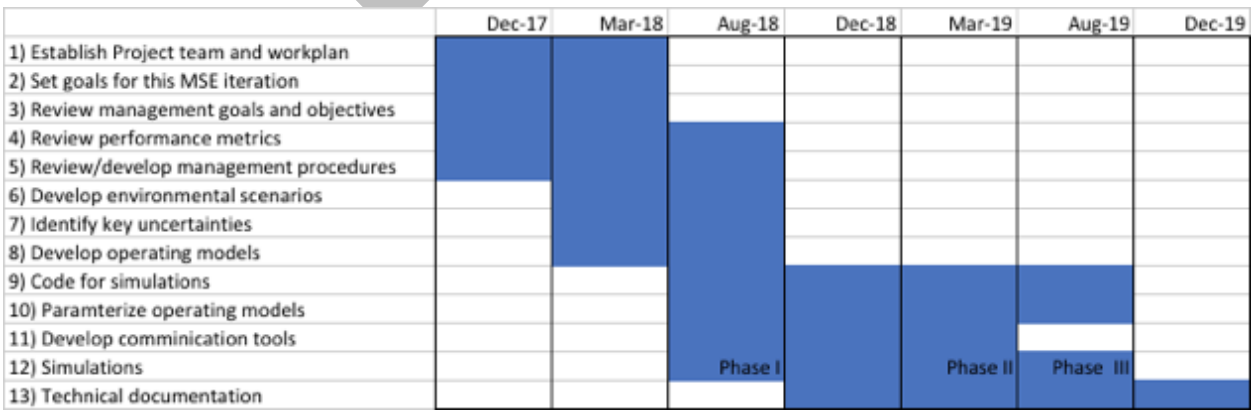
- MSE was a useful approach to understand the implications of decisions about model structure and parameters in the assessment model
- The MSE utility was somewhat limited by how similar the operating model and assessment model were
- A spatial operating model was a desirable next step

The hake MSE is entering a new iteration, supported in part by NOAA-funded grants to explore environmental drivers of hake distributions, and investments in a dedicated post-doc and staff time from the NWFSC MSE coordinator (K. Marshall). At the August 2017 JMC meeting, the JMC decided to re-form the MSE working group, made up of JMC and AP members to advise the MSE project team (MSE coordinator and analysts) and coordinate stakeholder feedback in the MSE process.

Tasks for the next 2 years of the Pacific Hake MSE (led by MSE project team in close collaboration with MSE working group)

1. Establish project team and MSE Working Group, roles and responsibilities, communication strategies, work plan
2. Establish goals for this iteration of the MSE (What problem are we trying to address?)
3. Review goals and objectives of managers (with feedback from MSE working group)
4. Review performance metrics (with feedback from MSE working group)
5. Review/develop management procedures to test (with feedback from MSE working group)
6. Develop environmental scenarios
7. Identify other types of scenarios (?)
8. Develop operating and estimation models
9. Develop computer code for closed loop simulation
10. Parameterize operating models
11. Develop communication tools for simulation results
12. Simulate each management strategy with each operating model, summarize and interpret performance statistics, and present 3 phases of simulation results
13. Technical documentation of results

Overview timeline for MSE tasks



Task 1: Establish MSE project team and MSE working group, roles and responsibilities, communication plan, and a work plan

Timeline: Draft work plan and communication plan by Dec 2017, input from MSEWG early 2018, review by SRG and full JMC in Feb/March 2018.

Deliverables: A work plan and timeline that are mutually agreed upon by the project team, MSE working group, and JMC.

Description and Relevance: A work plan is a general agreement between the project analysts and the MSE working group that lays out the scope of MSE activities. A communication plan supports this work plan by specifying expectations about frequency of contact and updates from the project team to the MSE workgroup and JMC. Both of these documents also identify roles and responsibilities.

Task 2: Establish goals for this iteration of the MSE
Timeline: Nov 2017 - March 2018

Deliverables: A clear goal statement of what this iteration of the MSE is trying to accomplish, reviewed and approved by the MSEWG and JMC

Description and Relevance: A goal statement shapes the scope of work on the MSE, which influences the structure of the operating and estimation models. For example, if the JMC's goal were to set a new management procedure for Pacific whiting, an MSE to achieve that goal may be structurally different than an MSE designed to explore the robustness of the current management procedures (data collection, assessment, harvest control rules) to current and future variable ocean conditions.

Task 3: Review and update management objectives
Timeline: November 2017 - March 2018

Deliverables: A list of objectives that captures the objectives of Whiting management

Relevance: The objectives of managers of the Hake fishery are used to develop performance metrics against which management procedures are evaluated.

Description: Objectives were elicited from the JMC and Hake Treaty documents in previous iterations of the MSE (2014-2015). This Task may only require a review of those previously derived objectives by the MSEWG to determine whether they are sufficient for this iteration of the MSE. If specifying additional/different objectives is desired by the JMC or MSEWG, then more time will be needed to discuss with the MSEWG and decide on those new objectives.

Task 4: Translate goals and objectives into performance indicators
Timeline: November 2017 - August 2018

Deliverables: A list of performance indicators and associated risk tolerances

Relevance: Performance indicators are used to evaluate the performance of management procedures under different scenarios.

Description: Performance indicators used in previous iterations of the MSE captured biomass, catch, and variability in catch. As with Task 3, if the performance indicators are unchanged from previous iterations of the MSE, this task is relatively straightforward. Because the new operating model will have spatial structure, we will at a minimum need to decide how/whether to report performance indicators by region (US/Canada). If the JMC or MSEWG desires, the MSE project team can also explore additional performance indicators.

Task 5: Specify management procedures to test
Timeline: November 2017 - August 2018

Deliverables: A list (or table) of alternative management procedures to evaluate with the closed loop simulation model

Relevance: Testing management procedures proposed by managers is the bread and butter of a MSE process. The relative performance of these procedures can be used to inform future decisions to adjust data collection, assessments, or harvest control rules.

Description: Management procedures can include data collection (e.g. survey frequency and extent), assessment model structures (e.g. spatial vs non-spatial assessment model), and harvest policies (e.g. harvest control rules or reference points). Depending on what the stated goals of the JMC are for this iteration of the MSE, we could explore harvest policies, monitoring procedures, assessment model structures, or all of the above. In previous iterations of the hake MSE, the performance of catch floors and ceilings were explored, as well as the performance of an age-1 index.

Task 6: Develop environmental scenarios
Timeline: January 2018-August 2018

Deliverables: A list of environmental scenarios to explore in the operating model, and how they will be specified (e.g. the shape of the relationship between an environmental driver and hake movement or recruitment and the range of variability in the environment for that driver)

Relevance: Interannual variability and long-term directional changes in ocean conditions could influence how well the hake management system performs with respect to stated management objectives. Variability in the ocean environment represents one dimension of “things we can’t control”.

Description: Developing environmental scenarios must occur alongside the development of the operating model. The current state of knowledge of interactions between hake biology and the environment should be captured by the operating model, and the uncertainty in those relationships and the range of variability in ocean conditions as they relate to hake movement, distribution, and recruitment should be captured in the environmental scenarios. For example, environmental variability could be represented as interannual variability, a regime-like process,

or directional change. Refining environmental scenarios will require discussions with the JMC, MSEWG, and JTC.

Task 7: Identify other scenarios to explore (?)
Timeline: January 2018 - August 2018

Deliverables: If desired, a list (or table) of parameters or processes for which exploring uncertainty is desired, specifying how each parameter or process will be represented (e.g., mean and variance).

Relevance: Identifying and defining the uncertainties to explore in the simulations bounds the variability among individual simulations from the closed loop operating model.

Description: In addition to the environmental scenarios above, the JMC/MSEWG may want to investigate the robustness of management procedures to other unknowns. Uncertainty generates "noise", or variation, among individual simulations of the closed loop operating model. Identifying uncertainty involves multiple steps/considerations. We want to identify the kinds of uncertainty that are mostly likely to affect the performance of the management procedures, and also the kinds of uncertainty that managers are most concerned about. Then, we need to decide how to represent those uncertainties. Developing scenarios to represent uncertainty in different ways allows us to explore hypotheses about how the system works.

Task 8: Develop Operating Models
Timeline: November 2017 - August 2018

Deliverables: A conceptual diagram and narrative description of each operating model describing their key features, spatial and temporal resolution, and how the model components interact.

Relevance: This task creates a roadmap for developing computer code for the simulation model and offers an early opportunity for feedback on model structure (March 2018).

Description: Simulation model components will likely include: hake population dynamics, fishery, survey, assessment, implementation. For each of these models, we will need to decide how to represent space (e.g., a model "box" for U.S. and Canada) and time (a weekly, monthly, quarterly, or annual time step). We also need to specify the equations that will represent each process. For example, how will movement rates be specified for hake across model boxes? Does each age-class move independently? Or do we represent movement as juvenile and adult movement rates? These decisions will need to be informed by the objectives of the JMC, existing knowledge about the system, data available, and computation time of fitting more fine-scale models to data. Current objectives for this iteration of the MSE will inform the structure of the OM, but potential future objectives should also be considered so that the models developed are transferable or expandable in future iterations of the MSE wherever possible.

Task 9: Develop computer code for closed loop simulation
Timeline: March 2018 - December 2018

Deliverables: a functional, tested, and documented codebase to run hake MSE simulations

Relevance: Writing the code to run the closed loop simulation can happen at the same time as development and parameterization of operating models.

Description: Previous iterations of the hake MSE were coded in ADMB and used the assessment model as the operating model. Adding complexity to the operating model (spatial and temporal complexity and environmental variability) requires new code to be developed. Developing the code also involves revisiting the structure of the program, file handling, and which language to use. All of these decisions should be made with software development best practices in mind.

Tasks 9 and 10 will occur simultaneously, and rely on each other. Code is required to parameterize and condition the model, and we must at least have a plan for how to parameterize and condition the model when we are developing the code.

Task 10: Parameterize and condition models
Timeline: March 2018 - June 2019

Deliverables: A parameterized model specifies all parameter values (by fitting the models to data or specifying fixed parameter values).

Relevance: A fully parameterized model is required to run the closed-loop simulations. Conditioning the models (fitting to observed data) ensures they produce realistic results given our knowledge of the system.

Description: Parameterizing the operating models requires specifying and documenting all the parameters in the model. This can be a multi-staged approach where initially, values are fixed, but in the final stages many parameters (values and uncertainty) will come from fitting (or conditioning) the model to the most recent assessment model. This model conditioning should occur in a step-wise fashion to ensure that as model complexity increases (more model components, or more spatial complexity), the simulations are producing realistic results, given what we know about hake biology, the fishery, the environment, etc.

Task 11: Develop communication tools for simulation results
Timeline: March 2018 - March 2019

Deliverables: Clear visuals that demonstrate the range of results from the simulation and performance of management procedures.

Relevance: Clear communication of results is required for MSE results to be useful to the JMC.

Description: MSEs produce thousands of simulation results. Summarizing these multidimensional data in effective ways that resonate with managers is key to success of the MSE. The MSE project team will explore best practices for visualizing complex model results through literature review, discussion with other MSE teams around the country, and discussions with the Hake MSE working group.

Task 12: Simulate each management strategy with the operating mode and summarize and interpret performance statistics
Timeline: July 2018 - August 2019

Deliverables: First phase of results by Aug 2018 (JMC meeting), second phase simulation results by March 2019 (SRG and JMC meetings), third phase simulation results by Aug 2019 (JMC meeting)

Relevance: Simulation results show how each management procedure (specified in task 4) performs with respect to each performance metric chosen (task 5), over a range of scenarios (identified in tasks 6 and 7).

Description: Simulations will be presented in multiple phases. The first round of simulation results will likely not include a fully parameterized, or fitted model, or exploration of all desired types of uncertainty. Feedback from the JMC on the first round of simulations can inform changes to model structure, parameter values, management procedures to test, or how results are visualized in future phases. A second set of simulation results will be presented in March 2019, and the third set of results presented in Aug 2019.

Task 13: Documentation of results
Timeline: Aug 2018 - Dec 2019

Deliverables: A technical document describing all of the components of the work plan (focusing on model structure, parameterization, and results) for review by the JMC.

Relevance: Documenting the technical details of the simulation model is required for the JMC and SRG to review the MSE

Description: This document is envisioned to be iterative, with increasing level of detail at each presentation to the JMC. For example, by the March 2019 SRG meeting, we expect to have a fully parameterized model for review by the JMC. Revisions to this model, or the management procedure to be tested will likely occur by the Aug 2019 JMC meeting, and the technical document will be subsequently updated.